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A new species of *Procambarus* (Crustacea: Decapoda: Cambaridae) from Veracruz, Mexico

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Abstract.—*Procambarus* (*Villalobosus*) *chacalli* is a new species of crayfish from ponds at Manantial de Dejigui, Huayacocotla County, Veracruz, Mexico. It can be placed in the Erichsoni Group of the subgenus because the gonopod (first pleopod) of the first form male has a flared, broadly curved caudal process. Within the Group it is most similar to *P.* (*V.*) *erichsoni* Villalobos and *P.* (*V.*) *contrerasi* (Creaser). It can be distinguished from these and other members of the subgenus by a combination of gonopod characters that includes a short mesial process with a slightly flattened, caudodistally directed tip; a cephalic process that originates on the caudal process and is longer than the other terminal elements, and a platelike caudal process with a strong fold on the caudolateral surface. Another distinctive character is the subovate annulus ventralis, with two stronger ventral crests that form a deep submedian depression, and a sinus that extends to the caudomedian margin.

The subgenus *Villalobosus* Hobbs, 1972, of the genus *Procambarus* Ortmann, 1905, as defined by Hobbs (1972), includes 10 species with the following characters: presence of hooks on the fourth pereiopods, and rarely vestigial hooks on the third pereiopods, of males; and asymmetrical gonopods that reach the coxae of the second pereiopods, with a tuberculiform or acute central projection. No new species has been described in this subgenus since Hobbs (1982) described *Procambarus* (*Villalobosus*) *cuetzalanae* Hobbs, 1982, from a series of springs, caves and deep holes in the environs of Cuetzalan, Puebla.

The species of *P.* (*Villalobosus*) inhabit the southern portion of the Huasteca region, within the states of Hidalgo, Puebla and Veracruz. This is a very mountainous region, with a number of narrow valleys and canyons that play an important role in isolating crayfish populations (López-Mejía 2001). The members of this subgenus have been found in rivers, small streams, impoundments, and springs, and in subterranean environments as stygophiles (Villalobos 1955; Hobbs 1975, 1982, 1984). The new species described herein has been found only in three ponds at the type locality, Manantial de Dejigui.

The specimens studied are deposited in the Colección Nacional de Crustáceos, Instituto de Biología, Universidad Nacional Autónoma de México (CNCR), and in the Colección de Crustáceos de Referencia, Universidad Autónoma Metropolitana—Unidad Xochimilco (CCR-UAMX). Other abbreviation used is: TCL, total carapace length.

***Procambarus* (*Villalobosus*) *chacalli*,**
new species
Figs. 1, 2

Diagnosis.—Body pigmented, eyes normally developed, facets well defined. Rostrum reaching distal border of third antennular article, length 15.8 to 20.8% (x = 17.9%, n = 26) of TCL, without marginal spines (Fig. 1A). Areola 4.9 to 7.2 (x = 5.9, n = 26) times as long as wide, length 32.3 to 38.6% (x = 35.1%, n = 26) of TCL, 39.7 to 46.1% (x = 42.8%, n = 26) of postorbital carapace length, with 2 or 3 punctuations across the narrowest part. Cervical and infraorbital spines absent, branchiostegal spine present. Antennal scale 1.8 to 2.3 (x = 2.1, n = 26) times longer than wide, with longitudinal groove throughout whole length, groove shallow anteriorly, becoming deeper posteriorly. Chelipeds shorter than total body length; mesial surface of palm of chela with 7 tubercles in irregular row, based on holotypic male form I; all tubercles with small tufts of short setae anteriorly; fingers as long as palm, both fingers with 3 longitudinal ridges along ventral and dorsal surfaces (Fig. 1C). Ischium of fourth pereiopod with hook extending beyond basioischial articulation (Figs. 1D–E), ischium of third pereiopod with vestigial hook. Cephalic lobe of epistome approximately hexagonal, with margins undulating slightly, irregular and asymmetrical anteriorly; lateral angles well defined, devoid of setae (Fig. 1F).

First pleopods of form I male asymmetrical, reaching coxae of second pereiopods, with 2 rows of scattered setae running throughout whole length, setae more abundant and longer proximally. Mesial process short, slightly truncated distally, directed distolaterally; central projection triangular, divided into 2 sections, caudocephalically oriented; cephalic process spiniform, directed distocephalically, longer than rest of terminal elements, originating on caudal process; caudal process in cephalic position platelike, corneous, wrapping around central projection, with strong fold on caudolateral margin (Figs. 2A–D, F–G). Preannular plate of female with 2 strong lateral crests extending laterally and surrounding annulus ventralis, with scattered short setae on posterior portion of plate (Fig. 1G). Preannular plate and annulus in loose contact. Annulus approximately circular, with 2 strong crests anteriorly, forming deep, V-shaped depression; posterior half of dextral crest curved laterally, becoming less defined; sinistral crest curving laterally to form tonguelike expansion; rectangular projection on medial posterior section, forming margin of sinus. In ventral view, postannular plate ovoid, in caudal view approximately conical; apical surface bearing small punctations with short setae; plate not in contact with annulus. First pleopods present in females.

Measurements of types.—Provided in Table 1.

Holotypic male, form I.—Body and eyes pigmented. Cephalothorax becoming thicker posterior to cervical groove, maximum width at posterior margin, 0.97 times length of abdomen. Areola 6.2 times as long as wide, 32.3% of TCL, with 3 punctations across narrowest part, with slight median crest; branchiocardiac grooves well defined. Surface of carapace densely punctate, punctations increasing in density laterally. Rostrum excavated dorsally, margins convergent, without spines; anterior width 2.9 mm, posterior width 3.8 mm. Acumen reaching distal border of third article of antennular peduncle, slightly shorter than antennal scale, tip oriented dorsally, length of acumen 28.2% of rostrum length, ventral keel without spines. Postorbital ridge straight, moderately strong, with very small cephalic tubercle. Suborbital angle acute, branchiostegal spine present on both sides of carapace, directed anteriorly. Cervical groove describing acute angle over hepatic region, cervical spine absent (Fig. 1B).

Abdomen slightly longer than carapace. Surface of somites covered with regularly distributed punctations. Uropods with pro-

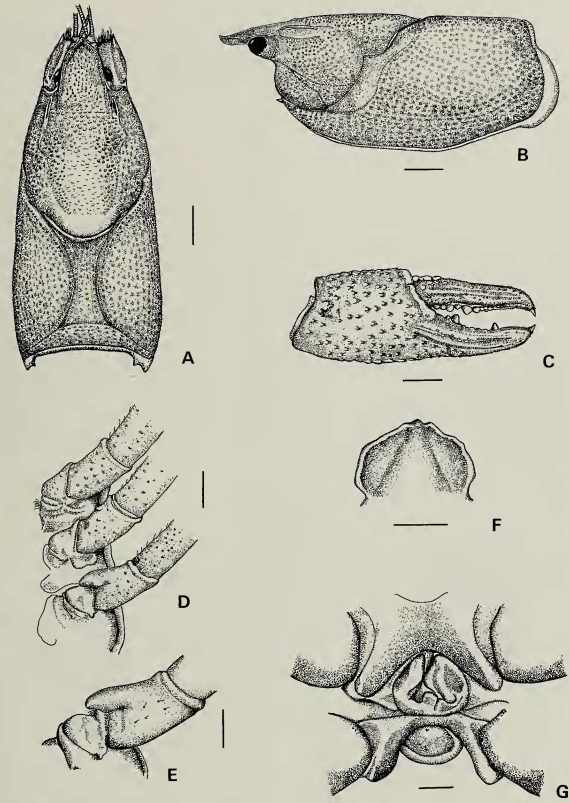

Fig. 1. *Procambarus* (*Villalobosus*) *chacalli*, new species, all from holotypic male, form I, except G from allotypic female. A, carapace, dorsal view; B, carapace, lateral view; C, distal podomeres of right cheliped; D, basal podomeres of left second, third and fourth pereiopods; E, detail of basis and ischium of left fourth pereiopod; F, epistome, cephalic lobe; G, annulus ventralis. Scale bars represent 3 mm (A, B, C), 2 mm (D, E), and 1 mm (F, G).

Table 1.—Measurements (mm) of type specimens of *Procambarus chacalli*, new species.

	Holotypic male, form I	Allotypic female	Morphotypic male, form II
Total length	51.2	55.5	48.7
Carapace			
Total length	24.1	26.9	23.6
Postorbital length	19.6	22.6	19.3
Width	11	12	10.2
Height	10	12.1	9.3
Areola			
Length	7.8	10.4	8.6
Width	1.2	1.7	1.7
Rostrum			
Length	4.5	4.25	4.2
Width	3.8	4.2	4.8
Antennal scale			
Length	3.9	4.1	3.5
Width	2.1	2.4	2.2
Cheliped			
Length of mesial margin of palm	10.5	9.5	10.5
Width of palm	7.5	7.1	7.1
Length of lateral margin of propodus	18.9	18.2	19
Length of dactyle	10.2	9.5	10.1
Length of carpus	6.8	6.6	7.3
Length of merus	10.7	10.7	10.3
Abdomen			
Length	27.1	28.6	25.1
Width	10.4	11.3	9.8

topodite bearing short spines; endopodite with dorsal median ridge ending posteriorly in small spine, and well developed distolateral spine. Telson covered with tufts of short setae, loosely forming 4 longitudinal rows; cephalic portion with 4 spines on posterolateral angle, two lateral ones larger, second one articulated.

Cephalic lobe of epistome irregular, without cephalomedian extension; distal half asymmetrical, with central depression. Antennule with prominent ventral spine on basal podomere, with setae on its base; antenna shorter than total body length. Antennal scale 1.8 times longer than wide, lateral margin ending in acute spine, maximum width at distal half (Fig. 2E). Third maxilliped reaching distal border of third article of antennal peduncle; internal margin of ischium with array of 26 irregular spines; all segments of third maxilliped with small tufts of short setae.

Chelae 1.2 times shorter than TCL, robust, ovate, 2.5 times longer than wide. Palm 1.4 times longer than wide, surface covered with small, blunt tubercles each with small tuft of setae; irregular row of tubercles along mesial surface. Movable finger with subsquamate tubercles anteriorly. Opposable margins of fingers with small tufts of setae; opposable surface of movable finger with 10 tubercles, that of fixed finger with 7 tubercles, third from base largest; both fingers ending in corneous tip.

Carpus of cheliped short, approximately conical, dorsal surface with scattered tubercles; lateral and ventral surfaces with small subsquamate tubercles, with tufts of short setae, distal margin with blunt spine on in-

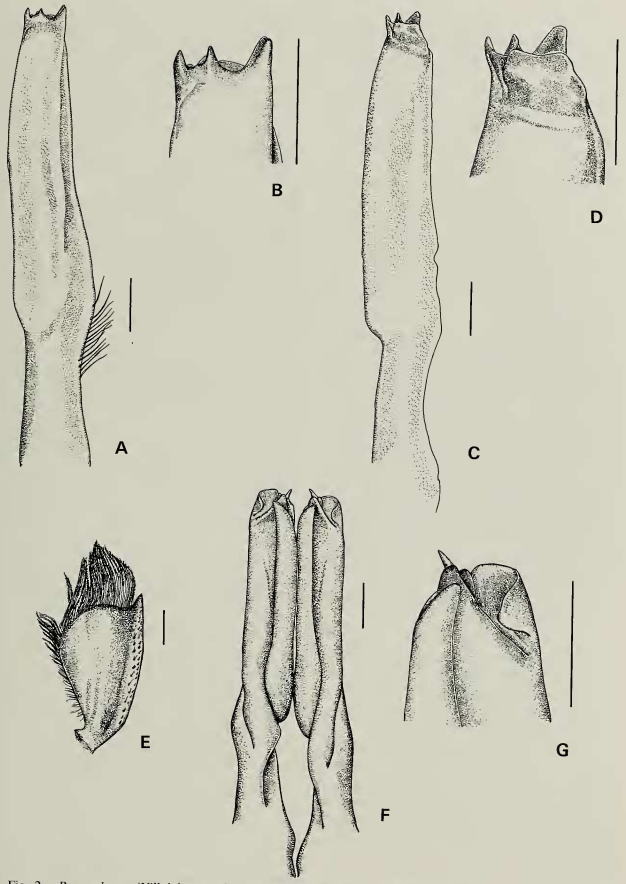

Fig. 2. *Procambarus* (*Villalobosus*) *chacalli*, new species, all from holotypic male, form I, except H from morphotypic male, form II. A, left gonopod, mesial view; B, detail of apex of left gonopod, mesial view; C, left gonopod, lateral view; D, detail of apex of left gonopod, lateral view; E, antennal scale; F, caudal view of gonopods; G, detail of apex of left gonopod, caudal view; H, caudal view of gonpods. Scale bars represent 1 mm.

ternal surface. Merus slightly tuberculate; dorsal surface with large, strong, subdistal tubercle, and other smaller tubercles; ventral surface with 2 longitudinal rows of blunt tubercles, distal margin with strong tubercle. Ischium with dorsal and ventral surfaces punctate, and row of 6 blunt tubercles along ventromesial margin, increasing in size distally.

Ischium of third pereiopod with vestigial hook, left and right sides different in size. Ischium of fourth pereiopod with strong, thick, cylindrical hook, extending beyond basioischial articulation, reaching midlength of basis. Coxa of fourth pereiopod with prominent acute boss on caudomesial ventral angle.

Gonopods as described in Diagnosis.

Allotypic female.—Similar to holotype, differing in following characters: telson bearing 2 movable spines on left caudolateral angle of cephalic portion and 1 on right side. Areola 6.2 times as long as wide. Antennal scale 1.8 times longer than wide. Eight tubercles on opposable margin of movable finger. Rostrum reaching first third of third article of antennular peduncle. Cephalic lobe of epistome asymmetrical as in holotype, distal border with small variations with respect to holotype. Annulus ventralis as described in Diagnosis.

Morphotypic male, form II.—Differing from holotype in following characters: first pleopod with apical elements poorly developed, cephalic process conical and reduced, central projection small, caudal process surrounding central projection, mesial process undefined. Areola 4.9 times as long as wide. Antennal scale 1.6 times longer than wide. Chelae with irregular row of four tubercles on surface of palm. Protuberance on ischium of third pereiopod extremely reduced. Ischium of fourth pereiopod with small hook, not surpassing basioischial articulation. Rostrum shorter, acumen reaching middle part of third podomere of antennal peduncle.

Type locality.—Nacimiento de Dejigui (altitude 1675 m), 4 km east of Huayacocotla, Municipio de Huayacocotla, Veracruz, Mexico (20°32′6″N, 98°26′15″W).

Disposition of types.—Holotypic ♂ form I, CNCR 20529; allotypic ♀, CNCR 20530; and morphotypic ♂ form II, CNCR 20531. Paratypes: 2 ♂ I, 2 ♂ II, 8 ♀, CNCR 20532; 5 ♂ II, 6 ♀ CCR-UAMX 1001.

Material examined.—All from type locality: 1 ♂ form I (CNCR 20529), 14 Nov 1999, coll. M. López-Mejía, L. M. Mejía-Ortíz; 1 ♀ (CNCR 20530), same date and coll. as holotype; 1 ♂ form II (CNCR 20531), 2 ♂ form I, 2 ♂ form II, 8 ♀ (CNCR 20532), 5 ♂ form II, 6 ♀ (CCR-UAMX 1001), 2 Nov 2001, coll. M. López-Mejía, L. M. Mejía-Ortíz, M. Signoret, J. A. Viccon-Pale, J. Cruz-Hernández, H. Solís.

Etymology.—The specific epithet "*chacalli*" is taken from the nahuatl word "chacalli", common name used for the crayfishes in northern Hidalgo, Mexico.

Remarks.—*Procambarus* (*Villalobosus*) *chacalli,* new species, can be placed in the Erichsoni Group due to the presence of a platelike caudal process on the male gonopod (Villalobos 1955). The new species is morphologically similar to *Procambarus* (*Villalobosus*) *contrerasi* (Creaser, 1931), and *Procambarus* (*Villalobosus*) *erichsoni* Villalobos, 1950, from which it may be distinguished by the following characters: a longer rostrum, with tip reaching the distal border of the third antennular article; a wider areola with a slight median crest; and an epistome bearing a cephalic lobe with an undulated surface. Regarding the gonopod morphology of the form I male, *P. chacalli* exhibits the following unique characters: a short and slightly truncated mesial process, directed distolaterally; a cephalic process which is the largest of the terminal elements, originating on the caudal process; and a platelike caudal process with a strong fold on the margin. In *P. erichsoni* and *P. contrerasi* the rostrum reaches the distal part of the second antennular article, the areola is narrower, and the surface of the espitome is smooth; their gonopods bear

shorter cephalic processes, that originate between the central projection and the mesial process, and the caudal process is slightly folded. The annulus ventralis of *P. chacalli* differs from those of *P. erichsoni* and *P. contrerasi* in the extension of the lateral projections of the preannular plate, the shape of the crests and sinus in the annulus, and the size and shape of the postannular plate.

Procambarus (*Villalobosus*) *chacalli* has been collected only at the type locality, where specimens were captured in three small, shallow ponds next to the spring. The largest pond was 8 m^2, and the deepest one was 0.4 m. The recorded water temperatures ranged from 18.9 to 20.4°C.

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